REMARKS

The foregoing amendments are made to correct minor translational errors and to meet United States requirements as to form. No new matter is added.

Respectfully submitted,

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

PARK et al.

Application No.:	09/839,594	Art Unit:	Unassigned
Filed:	April 23, 2001	Examiner:	Unassigned
For:	LOW DIELECTRIC COMPOSITE WITH NANO MAGNETIC PARTICLES, MANUFACTURING METHOD THEREOF, AND SEMICONDUCTOR DEVICE AND OPTICAL DEVICE USING THE SAME		

SPECIFICATION, CLAIMS AND ABSTRACT AS PRELIMINARILY AMENDED

Amendments to the paragraph beginning at page 1, line 11:

As an electromagnetic device, for example, a semiconductor device or a display device, has become highly integrated, it is necessary to employ a dielectric material having a relatively lower dielectric constant ~~to~~ in such a device.

Amendments to the paragraph beginning at page 1, line 22:

Accordingly, there have been various methods of forming an ~~insulting~~ insulating layer using a dielectric material having a low dielectric constant, for example, poly(benzoxazole) having a structure similar to that of polyamide and a low dielectric constant and exhibiting a good thermal stability, as disclosed in EP 903639, EP 905170,

EP 391200, EP 291779, EP 5123339, and EP 3716629. However, since poly(benzoxazole) has a poor photoactive property, it cannot be readily to be used as an interlayer dielectric (ILD) or an intermetal dielectric (IMD).

Amendments to the paragraph beginning at page 2, line 1:

U.S. Patent Nos. 5,114,780 and 5,115,082 disclose a dielectric material of fluorinated poly(acrylether) series, having a low dielectric constant of 2.6-2.7, which is however difficult to ~~be applied~~ apply to a semiconductor manufacturing process due to its low glass transition temperature, that is, approximately 260°C. To overcome the application difficulty, an attempt to raise the glass transition temperature up to approximately 400°C has been made. However, in this case. the dielectric constant is undesirably increased to 2.8.

Amendments to the paragraph beginning at page 2, line 13:

EP 0701283 Al discloses a low dielectric material having a diamond-like structure of tetrahedral configuration of all carbon atoms contained therein, which is an inorganic material having excellent thermal and mechanical stability, compared to the earlier proposed low dielectric materials, which are generally organic materials having poor thermal mechanical stability. Nevertheless, in order to reduce the dielectric constant, which is still high due to the dielectric constant of diamond, that is, approximately 5.7, there has been an attempt to add hydrogen and fluorine, resulting in serious degradation of thermal stability.

Amendments to the paragraph beginning at page 2, line 21:

U.S. Patent Nos. 5,470,802, 5,494,858, 5,504,042, and 5,523,615 disclose methods for reducing a dielectric constant by introducing air pores (for air, k=1) into SiO_2 or a polymer matrix such as polyamide. However, porous dielectrics based on the methods disclosed in the referenced patents have ~~a low~~ poor mechanical ~~property~~properties, a high

~~hygroscopic property~~ hygroscopicity due to a high surface energy and a low ~~electric intensity~~ dielectric strength.

Amendments to the paragraph beginning at page 2, line 26:

As an ultra low dielectric constant material of 2.5 or less becomes highly demanded in the semiconductor device manufacturing process, it is necessary to develop a novel ultra dielectric constant material which can ~~satisfying~~ satisfy requirements of a low dielectric constant, that is excellent in thermal and mechanical properties, has a low tendency of absorbing moisture, and has a high electric ~~intensity and so on~~ strength.

Amendments to the paragraph beginning at page 12, line 23:

The nano magnetic particle/PI composites were prepared using the matrix of PI having the above described properties. The nano magnetic fluid having 0.1 wt% solid content, prepared in step 3 of Example 1 and polyamic acid prepared in Example 2 were mixed in the ratio shown in Table 7, to prepare nano magnetic particle/polyamic acid, which was spin-coated at 2000 rpm for 60 seconds, 1 hour pre-baking was performed, and the temperatures were elevated step by step to 150°C, 200°C and 300°C at speeds of 5°C/min, 5°C/min and 2°C/min, respectively, each step having a dwell time of 1 hour, for imidization. Then, aluminum was deposited by thermal evaporation in the same manner as above to fabricate an electrode, and then a flat-panel capacitor. The dielectric constant of the resultant was measured using a ~~Keithyey~~ Keithly CV analyzer (see Table 7). As shown in Table 7, while the dielectric constant of pure polyamide is 3.15, the dielectric constants of NC-3 containing 0.55 wt% nano particles with respect to PI is reduced to 2.51.

Amendments to the existing claims:

3. (Amended) The composite according to claim 2, ~~wherein~~ including spherical nano magnetic particles ~~are added~~ in addition to the non-spherical nano magnetic particles.

5. (Amended) The composite according to claim 1. wherein the matrix is ~~made of one~~ selected from the group consisting of silica, alumina, and hydrosilsesquioxane.

6. (Amended) The composite according to claim 1, wherein the matrix is ~~made of one~~ selected from the group consisting of polyimide, PMMA, and methyl silsesquioxane.

8. (Amended) The composite according to claim 7, ~~wherein~~ including diamagnetic nano magnetic particles ~~are added~~ in addition to the superparamagnetic nano particles.

11. (Amended) The composite according to claim 1, wherein the nano magnetic particles ~~consists~~ are selected from the group consisting of (γ-Fe_2O_3), chromium oxide (CrO_2), europium oxide (EuO), NiZn-ferrite, MnZn-ferrite ~~or Yittrium~~, and ytrium-iron garnet.

21. (Amended) A method for manufacturing a composite comprising ~~the steps of~~:
forming nano magnetic particles; and
distributing the nano magnetic particles ~~into~~ in a dielectric matrix.

22. (Amended) The method according to claim 21, wherein ~~the step of~~ forming nano magnetic particles includes ~~the steps of~~ mixing a cation surfactant with an anion surfactant of a metal salt to form a mixture and subjecting the mixture to chemical sedimentation to form non-spherical nano magnetic particles.

Amendments to the abstract:

ABSTRACT

A composite containing nano magnetic particles is provided. The composite includes nano magnetic particles in a dielectric matrix. The matrix is made of an inorganic material such as silica, alumina, or hydrosilsesquioxane, or an organic material such as polyimide, polymethyl methacrylate (PMMA), or methyl silsesquioxane. The nano magnetic particles consist of (y-Fe_2O_3), chromium oxide (CrO_2), europium oxide (EuO), NiZn-ferrite, MnZn-ferrite, ~~Yittrium~~ ytrium-iron garnet, or indium (In).